RESEARCH NOTE

INFLUENCE OF RELIGIOUS AND CULTURAL BELIEFS ON CONTACT WITH BATS IN THAILAND

Kanokwan Suwannarong[1], Kathleen O'Rourke[2], Thanomsin Ponlap[2], Phitsanuruk Kanthawee[3], Worakamon Thongkan[2], Wattanachai Boonlakorn[2] and Alongkorn Amonsin[1]

[1]Center of Excellence for Emerging and Re-emerging Infectious Diseases in Animals, Faculty of Veterinary Science, Chulalongkorn University, Bangkok, Thailand; [2]SUPA71 Co Ltd, Bangkok, Thailand; [3]School of Health Science, Mae Fah Luang University, Chiang Rai Province, Thailand

Abstract. Religious and cultural beliefs may influence how people interact with wild animals. In this study, we aimed to assess the association between beliefs and how people interact with bats at a selected study site in Ang Thong Province, Thailand, in order to obtain in-depth information on cultural, region, and beliefs related to people behaviors contacting with bats. Results of this study would be useful in planning communication intervention in order to reduce the risk of contracting bat-borne diseases in the area. Study subjects were those who reported contacting with bats in the area during scoping visit and the study subjects must have lived in the study area for at least one year. Focus group discussions (FGDs) were held with study subjects to determine the history of interaction with Lyle's flying foxes in the trees around the Buddhist temple and wrinkle-lipped bats living in the monks' and villagers' houses. The study was conducted during May-July 2017. A total of 20 subjects were included in the study (10 males and 10 females). The mean age (range) was 44 (20-75) years old. The FGD revealed the villagers believed the bats to be disciples of statue of the Buddha. They believed killing the bats living in the temple would result in a curse but killing bats not associated with the temple was not considered wrong. The results of the study show religion beliefs of our study subjects affected with behaviors toward bats in the study areas and may result in an increased risk for exposure to bat-borne pathogens. Further studies are needed to determine the prevalence of these beliefs and actions and to determine it is associated with diseases among residents living in the study area. Further studies are also needed to determine how these beliefs and behaviors can be modified within the culture and religion of the study area.

Keywords: bat, belief, contact, religion, Thailand

Correspondence: Alongkorn Amonsin, Center of Excellence for Emerging and Re-emerging Infectious Diseases in Animals, Department of Veterinary Public Health, Faculty of Veterinary Science, Chulalongkorn University, Bangkok 10330, Thailand.
Tel: +66 (0) 2218 9578; Fax: +66 (0) 2218 9577
E-mail: alongkorn.a@chula.ac.th

INTRODUCTION

Bats may host a variety of pathogens and have been reported to be important reservoirs for viruses transmitted to other animals and humans (Calisher *et al*, 2006; Han *et al*, 2015; Olival *et al*, 2017). The most notable bat-derived zoonotic pathogens include Nipah, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERs-CoV), and Ebola (Epstein *et al*, 2006; Luis *et al*, 2013). SARS-CoV2, causing pandemic coronavirus disease 2019 (COVID-19) may also be transmitted from bats to humans (Zhang *et al*, 2020). These emerging infectious diseases (EIDs) may be transmitted directly from bats to humans or via intermediate hosts, such as livestock or wildlife (Newman *et al*, 2011). Humans may come into contact with bats through several activities. In Thailand, bats are hunted and sold for consumption (Suwannarong *et al*, 2020) and bat guano collection plays an important role in economy and considerable public health risk due to the presence of bat-borne pathogens in guano (Wacharapluesadee *et al*, 2013; Chan *et al*, 2015; Suwannarong and Schuler, 2016).

Prevention of these diseases requires understanding human and animal interactions; this can be accomplished through clinical, epidemiological, environmental and social science methods (Goh *et al*, 2000; Hossain *et al*, 2008). However, human-bat interactions have not been well studied (Wood *et al*, 2012). In this study, we aimed to evaluate the effect on religious and cultural beliefs on human-bat interactions among villagers who live near a Buddhist temple in Ang Thong Province, Thailand in order to obtain in-depth information on cultural, region, and beliefs related to people behaviors on contacting with bats. Results of this study would be used in planning communication intervention to reduce the risk of contracting bat-borne diseases in the area.

MATERIALS AND METHODS

Study design, study site, and study period

For this study, we used focus group discussions (FGD) to determine the study subjects' beliefs and interactions with bats. The study was performed in a selected village, Ang Thong Province in central Thailand. We selected this village because there is a Buddhist temple. The temple contains a 100-year old statue of Buddha that is considered holy and much respected by the people of the village. Dense trees surround the temple (Fig 1A) are home to Lyle's flying foxes (also called fruit bats) (Fig 1B). Inside the monks' and villagers' houses live wrinkled-lipped bats. The study was conducted during May-July 2017.

This study was approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University (Approval No. 034/59). It was also approved by the Ang Thong Provincial Health Office and local provincial authorities. Written informed consent was obtained from all subjects prior to participation in the study.

Data collection methods, selection of the participants, and data analysis

Data regarding subjects' beliefs and interactions with the bats in this community was obtained through FGDs. An experienced social scientist researcher led the discussions and 2 note-takers recorded the responses of the subjects' along with making discussion notes. The discussion topics were chosen after a review of the literature (Jenkins and

Racey 2008, Suwannarong and Schuler 2016). Subjects were asked about their interactions with bats, demographics, their knowledge, attitudes, and practices regarding bats, their cultural beliefs, religious beliefs, and religious activities. The participants were selected purposively. They needed to have lived in the study community for at least one year and were able to speak Thai. Twenty subjects were chosen because of their bat contact history during scoping visit; 10 males and 10 females. Data were analyzed by making transcripts of the audio recordings and using keywords to thematically codes the responses using NVivo qualitative analysis software, version 10 (QSR International Corp, Zhubei, Taiwan).

RESULTS

A total of 20 subjects participated in the study, 50% male. The average age was 44 years old. The subject occupations were agriculture related occupations (7, 35.0%), business owners or food vendors (5, 25.0%), temporary daily employees (4, 20.0%), government employees or officers (3, 15.0%), and a monk (1, 5.0%). Fifty percent of subjects had a history of direct or indirect contact with bats during the previous years, such as cleaning bat guano or entering areas with bats present. Seventy-five percent of the subjects went to the temple frequently, at least once a week, to worship and ask for good health and good luck. All of them considered the bats living in the temple as sons or disciples of Buddha. They supported this belief by describing the bat behaviors, slotting the bats did not fly over the Buddhist church, but instead flew around the statue of Buddha three times to show their respect. Circumambulation, moving around a holy object or idol, is a Buddhist devotional practice.

Study subjects believed a bat's death outside the temple was the bat's retirement from monkhood. They also stated killing or eating these bats results in a curse. These are the main reasons they did not catch or kill the bats in the temple. The study subjects believed the bats at the temple were important for using as medicine to cure asthma. A research team had previously came to capture the bats but the study subjects stated the team was asked to pray before doing the capture. The study subjects believed bats living outside of the temple could be hunted without first making an offering. They stated that villagers are free to hunt, kill, consume, or otherwise use bats not associated with the temple. They also believed hearing a bat scream during the daytime meant there was an upcoming death, whether or not the bat was associated with the temple.

DISCUSSION

Our results showed that the Buddhism religious and cultural beliefs affected the subject interactions with bats. These beliefs have resulted in fewer interactions between subjects and bats which may reduce the risk of subjects being exposed to some bat-borne diseases, but sharing a worship area may increase the risk for exposure to bat guano, which in a study from Bangladesh was found to contain Nipah virus (Luby *et al*, 2006). Our findings were similar to a study from Cameroon that reported religious beliefs influenced interactions with wildlife (Ngoufo *et al*, 2014). A study conducted in both Iran and India reported subjects believed it was bad luck to kill bats (Frembgen 2006). In Madagascar, bats and butterflies are treated with great respect; bats are seen as incarnations of ancestors, and it is taboo to kill them (Wilson 1987).

Fig 1-Study site in Ang Thong Province showing (A) dense trees in the temple as a home of bats and (B) fruit bats in the trees.

In our study, cultural and religious beliefs decreased direct human-bat contact but increased indirect human-bat contact. It is important to consider such beliefs when developing intervention strategies to reduce human-bat contact. Our study cannot be applied to other populations due to its single-site design. Further studies are needed covering larger areas and including other types of animals to better understand beliefs affecting human-animal contact in order to reduce the risk of contracting animal-borne diseases in Thailand.

ACKNOWLEDGMENTS

The authors would like to thank the Ang Thong Chief Medical Officers and staff of the local health facilities for their cooperation and assistance during the research. Special thanks to an abbot of the temple for his support during the data collection process, Mr Nuttapong Mekvipad for his assistance with answer coding, and Ms Sara Woldehanna and Ms Aliyah Evangelista for their suggestion with the manuscript preparation.

Chulalongkorn University provided financial support to the Center of Excellence for Emerging and Reemerging Infectious Diseases in Animals (CUEIDAs) and the One Health Research Cluster. Chulalongkorn University's Macadamize Compute Fund provided a postdoctoral fellowship to the first author. This study was also supported by the Second Century Fund (C2F), Chulalongkorn University. The Thailand Research Fund provided a Thailand Senior Scholar fund to the corresponding author (RTA6080012).

REFERENCES

Calisher CH, Childs JE, Field HE, Holmes KV, Schountz T. Bats: important reservoir hosts

of emerging viruses. *Clin Microbiol Rev* 2006; 19: 531-45.

Chan JF, Lau SK, To KK, Cheng VC, Woo PC, Yuen KY. Middle East respiratory syndrome coronavirus: another zoonotic betacoronavirus causing SARS-like disease. *Clin Microbiol Rev* 2015; 28: 465-522.

Epstein JH, Field HE, Luby S, Pulliam JR, Daszak P. Nipah virus: impact, origins, and causes of emergence. *Curr Infect Dis Rep* 2006; 8: 59-65.

Frembgen JW. Embodying evil and bad luck: stray notes on the folklore of bats in Southwest Asia. *Asian Folkl Stud* 2006; 65: 241-7.

Goh KJ, Tan CT, Chew NK, *et al*. Clinical features of Nipah virus encephalitis among pig farmers in Malaysia. *N Engl J Med* 2000; 342: 1229-35.

Han HJ, Wen HL, Zhou CM, *et al*. Bats as reservoirs of severe emerging infectious diseases. *Virus Res* 2015; 205: 1-6.

Hossain MJ, Gurley ES, Montgomery JM, *et al*. Clinical presentation of nipah virus infection in Bangladesh. *Clin Infect Dis* 2008; 46: 977-84.

Jenkins RKB, Racey PA. Bats as bushmeat in Madagascar. *Madagascar Conserv Dev* 2008; 3: 22-30.

Luby SP, Rahman M, Hossain MJ, *et al*. Foodborne transmission of Nipah virus, Bangladesh. *Emerg Infect Dis* 2006; 12: 1888-94.

Luis AD, Hayman DT, O'Shea TJ, *et al*. A comparison of bats and rodents as reservoirs of zoonotic viruses: are bats special? *Proc Biol Sci* 2013; 280: 20122753.

Newman SH, Field H, Epstein J, De Jong C, editors. Investigating the role of bats in emerging zoonoses: balancing ecology, conservation and public health interest. Rome: Food and Agriculture Organization; 2011.

Ngoufo R, Yongyeh N K, Obioha EE, Bobo KS, Jimoh SO, Waltert M. Social norms and cultural services - community belief system and use of wildlife products in the northern periphery of the Korup National Park, South-West Cameroon. *Change Adaptation Socioecol Syst* 2014; 1: 26-34.

Olival KJ, Hosseini PR, Zambrana-Torrelio C, Ross N, Bogich TL, Daszak P. Host and viral traits predict zoonotic spillover from mammals. *Nature* 2017; 546: 646-50.

Suwannarong K, Chanabun S, Kanthawee P, *et al*. Risk factors for bat contact and consumption behaviors in Thailand; a quantitative study. *BMC Public Health* 2020; 20: 841.

Suwannarong K, Schuler S. Bat consumption in Thailand. *Infect Ecol Epidemiol* 2016; 6: 29941.

Wacharapluesadee S, Sintunawa C, Kaewpom T, *et al*. Group C betacoronavirus in bat guano fertilizer, Thailand. *Emerg Infect Dis* 2013; 19: 1349-51.

Wilson JM. The crocodile caves of Ankarana, Madagascar. *Oryx* 1987; 21: 43-7.

Wood JL, Leach M, Waldman L, *et al*. A framework for the study of zoonotic disease emergence and its drivers: spillover of bat pathogens as a case study. *Philos Trans R Soc Lond B Biol Sci* 2012; 367: 2881-92.

Zhang T, Wu Q, Zhang Z. Probable pangolin origin of SARS-CoV-2 associated with the COVID-19 outbreak. *Curr Biol* 2020; 30: 1346-51.